



Bridging the Theory-Practice Gap: Exploring Instructors' Perceptions of Multimodal Hypercontent E-Modules for Firearms Training in Military Schools

Ardiyan Eko Saputro^{1(*)}, Akhmad Arif Musadad², Triana Rejekiningsih³

^{1,2,3}Faculty of Teacher Training and Education, Universitas Sebelas Maret, Surakarta, Indonesia

Abstract

Received : June 23, 2026
Revised : July 23, 2026
Accepted : August 28, 2026

This study aimed to analyze instructors' perceptions of the use of Multimodal Hypercontent E-Modules in teaching firearms knowledge and shooting skills at military schools. The study employed a quantitative approach with a descriptive survey design. The participants consisted of five firearms knowledge and shooting skills instructors at the Indonesian Air Force Officer Formation School (Setukpa TNI AU), who were selected using total sampling. Data were collected through a structured questionnaire developed based on the Technology Acceptance Model (TAM), consisting of the dimensions of perceived usefulness, perceived ease of use, and perceptions of multimodal-hypercontent features. The data were analyzed using descriptive statistics, including mean scores, standard deviations, and percentages. The results showed that instructors had a very high perception of the use of Multimodal Hypercontent E-Modules, with an overall mean score of 3.60 (90.00%). The multimodal-hypercontent dimension obtained the highest score ($M = 3.75$), followed by perceived usefulness ($M = 3.55$) and perceived ease of use ($M = 3.50$). These findings indicated that instructors perceived E-modules as useful, easy to use, and potentially supportive of procedural skills learning through the integration of various information representations. The multimodal and hypercontent features were perceived as capable of connecting theoretical materials with procedural visualizations that approximated real-world practice conditions. Overall, Multimodal Hypercontent E-Modules were perceived as having the potential to support digital learning innovations in military education contexts, particularly for high-risk procedural skills training.

Keywords:

Hypercontent E-modules; multimodal learning; instructors' perceptions; military education; firearms training

(*) Corresponding Author: ardiyan.ekosaputro@student.uns.ac.id

How to Cite: Saputro, A. E., Musadad, A. A., & Rejekiningsih, T. (2026). Bridging the Theory-Practice Gap: Exploring Instructors' Perceptions of Multimodal Hypercontent E-Modules for Firearms Training in Military Schools. *JTP - Jurnal Teknologi Pendidikan*, 28(2), 647-659. <https://doi.org/10.21009/jtp.v28i2.70361>

INTRODUCTION

Firearms training is a crucial component of military education, aiming to develop personnel competency in the proper use, maintenance, and application of firearm safety procedures (Hasibuan & Wibowo, 2024). Unlike general conceptual learning, firearms training represents a high-risk procedural learning that requires simultaneous mastery of knowledge, technical skills, and adherence to safety standards. Learning success in this context is determined not only by conceptual understanding but also by learners' ability to apply procedures accurately and consistently in practical situations (Muhadi et al., 2025).



Data show that accidental discharges contribute significantly to non-combat injuries, with an estimated incidence rate of 0.4% to 1.2% per 1,000 personnel per year in some infantry units globally (Trente et al., 2026; US Army Safety Center, 2022). Accidental firearm discharges may result in injuries, fatalities, legal consequences, and decreased public trust. Most of these incidents are associated with cognitive failures in recalling critical safety procedures under conditions of stress or fatigue (Kooijman et al., 2025). Therefore, firearms training requires learning strategies and instructional media that can effectively bridge theoretical understanding with practical implementation.

Although practical training is a key component of military education, its implementation often faces various limitations, including restricted training time, high operational costs, limited ammunition availability, and stringent safety requirements (Bruzzzone & Massei, 2017). These conditions restrict learners' opportunities for repeated practice, potentially creating a theory-practice gap. This gap presents a significant challenge because learners may understand theoretical concepts but still experience difficulties in applying procedures correctly in real-world training situations. In procedural skills learning, the ability to transform conceptual knowledge into operational actions is a crucial aspect of learning success (Beeler et al., 2023).

One contributing factor to this gap is the continued dominance of static textual and visual learning materials. This type of media is relatively effective for conveying declarative information but is less capable of representing complex and sequential procedures that require dynamic visualization (Pillai et al., 2026). This concern is echoed in the Indonesian higher education context, where Andayani et al. (2024) found that students' choice of effective learning media was largely determined by technology accessibility and the complexity of the learning material itself, underscoring the need for media that can accommodate more dynamic and interactive forms of content delivery. However, procedural skills learning requires representations that can demonstrate procedural stages, relationships among procedures, component functions, and the consequences of each action. In 21st-century education, developments in digital technology have opened opportunities to provide more interactive, flexible, and contextual learning experiences through the integration of various forms of information representation within a single learning environment (Fei, 2024; R. E. Mayer, 2021).

One innovation that has the potential to address this need is the Multimodal Hypercontent E-Module. Hypercontent refers to a form of digital learning material development that enables the integration of various learning resources through hyperlinks, allowing learners to navigate information flexibly. Unlike conventional digital modules, which tend to present information sequentially, hypercontent provides learners with opportunities to explore learning materials through various supporting resources according to their learning needs. This approach supports the characteristics of digital learning, which emphasize flexible access, interactivity, and independent learning (Selano et al., 2024; Simbolon et al., 2021). Prior research in Indonesian educational settings has similarly shown that the development of electronic modules is closely linked to learners' perceptions, interest, and motivation, further supporting the relevance of examining user perceptions when introducing digital module-based learning materials (Syahrial et al., 2019).

In addition to the hypercontent aspect, a multimodal approach is a crucial component in the development of digital learning media. Multimodal learning refers to the use of various information representations, such as text, images, audio, video, animation, and simulations, to support learners' understanding of concepts and procedures more comprehensively (Drajati et al., 2025; Fei, 2024). The integration of these representation modes enables learners to gain richer learning experiences and supports deeper knowledge construction processes.

Empirical evidence from Indonesian educational technology research supports the value of such multimodal representations: Ramadhan et al. (2022) demonstrated that augmented reality-based multirepresentation approaches improved students' cognitive learning outcomes, while Sukmawati et al. (2023) found that virtual reality-based learning enhanced students' understanding of complex, procedurally structured content. These findings suggest that multimodal visualization technologies can meaningfully support the comprehension of procedures and sequential actions, which is directly relevant to firearms training. In the context of firearms training, Multimodal Hypercontent E-Modules have the potential to facilitate the visualization of weapon handling procedures, simulation of procedural steps, and independent review of learning materials before learners participate in practical field training (Rahate et al., 2021).

Theoretically, the use of multimodal learning media is supported by the Cognitive Theory of Multimedia Learning (CTML), which explains that learning becomes more effective when information is presented through complementary verbal and visual representations (R. E. Mayer, 2021). The integration of various forms of representation enables learners to construct more effective mental models, thereby facilitating the understanding of complex concepts and procedures (R. Mayer, 2024). Furthermore, developments in digital technology have encouraged the emergence of more interactive and learner-centered learning environments. Within these environments, learners can access various learning resources, manage their learning processes independently, and construct understanding through interactions with diverse information representations (Drajati et al., 2025).

Various studies have shown that multimodal and immersive learning technologies contribute positively to learning quality. Radianti et al. (2020) found that virtual and immersive learning technologies could increase student engagement, motivation, and learning experiences across various educational contexts. Research by Qiu et al. (2023) showed that metaverse-based learning environments had the potential to create more interactive and meaningful learning experiences. Furthermore, Mills et al. (2025) reported that virtual and augmented reality environments could support self-directed multimodal learning and enhance students' procedural understanding. These findings indicated that the integration of multimodal technologies and digital learning environments had the potential to support the mastery of skills requiring advanced procedural understanding.

However, most previous studies have focused on learners in general education and higher education contexts. Research examining the application of multimodal learning technologies within military education settings remains relatively limited, particularly in high-stakes procedural skills training. Furthermore, previous studies have generally positioned learners as the primary subjects, whereas instructors' perceptions of learning technology use remain

understudied. This issue is important because successful educational technology implementation is significantly influenced by users' perceptions and acceptance of the technology. According to Scherer et al. (2019), users' perceptions of technology usefulness and ease of use are critical factors influencing successful technology adoption in learning environments.

Instructor perceptions play an important role in the successful implementation of learning technology because technology acceptance influences the sustainability of educational innovations. The Technology Acceptance Model (TAM) explains that technology acceptance is primarily influenced by two key constructs: perceived usefulness and perceived ease of use (Davis, 1989). A meta-analysis conducted by Scherer et al. (2019) showed that both constructs had significant relationships with technology acceptance across various educational contexts. Therefore, analyzing instructor perceptions is necessary to understand readiness for implementing Multimodal Hypercontent E-Modules in military education settings.

Based on this background, a research gap was identified due to the limited studies examining instructors' perceptions of Multimodal Hypercontent E-Modules in firearms training within Indonesian military education. Most prior research has focused on learners, general education, or immersive technologies, while instructors as decision-makers in high-stakes procedural skills training remain understudied. In this context, instructors are not only users of instructional technology but also key decision-makers in determining the suitability of digital learning resources for procedural training. This study therefore investigates military instructors' perceptions of Multimodal Hypercontent E-Modules as a digital learning medium to support firearms knowledge and shooting skills. Specifically, it examines instructors' perceived usefulness, perceived ease of use, and the perceived contribution of multimodal and hypercontent features in supporting firearms knowledge and shooting skills training. Theoretically, this study provides contextual evidence for applying the Technology Acceptance Model (TAM) to high-risk procedural learning in military education by examining technology acceptance from the instructor perspective. It therefore extends the application of TAM beyond conventional educational settings to a specialized, high-risk procedural training context. Practically, the findings are expected to inform educational technology development in military contexts and guide the integration of digital media into high-risk procedural training.

METHODS

Research Design

This study employed a quantitative approach with a descriptive survey design to analyze instructors' perceptions of the use of Multimodal Hypercontent E-Modules in firearms training at a military school. The study focused on instructors' perceptions regarding perceived usefulness (PU), perceived ease of use (PEOU), and the contribution of multimodal and hypercontent features in supporting the learning process. The research framework was developed based on the Technology Acceptance Model (TAM) proposed by Davis (1989).

Participants and Research Setting

The study was conducted at the Indonesian Air Force Officer Formation School (Setukpa TNI-AU). The participants consisted of five firearms and marksmanship instructors who were actively involved in firearms knowledge and shooting skills training activities. Due to the limited population size, this study employed total sampling, in which all instructors who met the predetermined criteria were included as participants.

The participant criteria included: having a minimum of three years of experience in teaching firearms and marksmanship; having experience in utilizing digital learning media; and being willing to participate in the study. These criteria were established to ensure that participants had sufficient experience and familiarity with both firearms training and the implementation of digital learning media.

Research Instrument

The research instrument was a structured questionnaire designed to measure instructors' perceptions of Multimodal Hypercontent E-Modules. The questionnaire consisted of 12 items distributed across three dimensions, with four items for each dimension: perceived usefulness (PU), perceived ease of use (PEOU), and perception of multimodal and hypercontent features. The instrument was developed based on the Technology Acceptance Model (TAM) proposed by Davis (1989). The instrument consisted of three main dimensions. The first dimension was perceived usefulness (PU), which referred to instructors' perceptions of the benefits of Multimodal Hypercontent E-Modules in supporting firearms and marksmanship training. The second dimension was perceived ease of use (PEOU), which referred to instructors' perceptions regarding the ease of accessing, operating, and integrating E-modules into the learning process. The third dimension was perception of multimodal and hypercontent features, which referred to instructors' views regarding the contribution of visual elements, procedural videos, self-navigation features, and material accessibility in supporting learners' understanding (Mills et al., 2025).

Data Collection

Data were collected using a structured questionnaire with a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). The questionnaire was distributed to firearms and marksmanship instructors at Setukpa TNI-AU after the participants received information regarding the purpose and procedure of the study.

The collected responses represented instructors' perceptions regarding the usefulness, ease of use, and potential contribution of Multimodal Hypercontent E-Modules in supporting firearms knowledge and shooting skills training.

Data Analysis

The collected data were analyzed using descriptive statistics with the assistance of Microsoft Excel and SPSS software. The analysis included calculating the mean score, standard deviation, and percentage for each indicator and dimension. The results were used to describe instructors' perceptions of Multimodal Hypercontent E-Modules in firearms training.

The mean scores were interpreted based on category intervals derived from the score range of the four-point Likert scale. The category interval was obtained by calculating the difference between the maximum and minimum scores and dividing it by the number of categories. Based on this calculation, the interval width was 0.75. The average scores were then classified into four categories: very low, low, high, and very high, as presented in Table 1.

Table 1. Score Interpretation Categories

Score Range	Category
3.26-4.00	Very High
2.51-3.25	High
1.76-2.50	Low
1.00-1.75	Very Low

RESULTS & DISCUSSION

Results

Data collected from Indonesian Air Force (TNI-AU) Setukpa instructors were analyzed to examine their perceptions of Multimodal Hypercontent E-Modules across three main dimensions: perceived usefulness, perceived ease of use, and multimodal-hypercontent features.

Instructors' Perceptions of Multimodal Hypercontent E-Modules

The results of the descriptive statistical analysis of instructors' perceptions are presented in Table 2.

Table 2. Descriptive Statistics of Instructors' Perceptions Across Dimensions

Indicator	Mean	Percentage (%)	Category
<i>Perceived Usefulness</i>	3.55	88.75	Very High
<i>Perceived Ease of Use</i>	3.50	87.50	Very High
<i>Multimodal or Hypercontent</i>	3.75	93.75	Very High
Average	3.60	90	Very High

Based on Table 2, the multimodal-hypercontent dimension obtained the highest score, with a mean score of 3.75 (93.75%), followed by perceived usefulness ($M = 3.55$; 88.75%) and perceived ease of use ($M = 3.50$; 87.50%). Overall, instructors' perceptions of Multimodal Hypercontent E-Modules obtained an overall mean score of 3.60, equivalent to 90.00% of the maximum score, which was categorized as very high.

Perceived Usefulness

The results of the descriptive statistical analysis of instructors' perceptions regarding the perceived usefulness dimension are presented in Table 3.

Table 3. Descriptive Statistics of the Perceived Usefulness Dimension

Indicator	Mean	SD	Category
E-module as adaptive teaching materials	3.60	0.55	Very High
E-module enhances active learning	3.40	0.55	Very High
E-module supports modernized learning	3.60	0.55	Very High
E-module as modern and professional teaching materials	3.60	0.55	Very High
Average	3.55	0.55	Very High

Based on Table 3, all indicators of perceived usefulness were categorized as very high. The indicators with the highest scores were instructors' perceptions that the E-module served as adaptive teaching material, supported learning modernization, and functioned as modern and professional instructional material ($M = 3.60$). These findings indicated that instructors perceived Multimodal Hypercontent E-Modules as beneficial learning media for supporting firearms knowledge and marksmanship training.

Perceived Ease of Use

The results of the descriptive statistical analysis of instructors' perceptions regarding the perceived ease of use dimension are presented in Table 4.

Table 4. Descriptive Statistics of the Perceived Ease of Use Dimension

Indicator	Mean	SD	Category
E-module is easy to use	3.40	0.55	Very High
E-module supports adaptation of learning approaches	3.40	0.55	Very High
E-module is compatible with available devices	3.60	0.55	Very High
E-module is easy to integrate into learning activities	3.60	0.55	Very High
Average	3.50	0.5	Very High

Based on Table 4, all indicators of perceived ease of use received very high ratings. The indicators with the highest scores were the compatibility of the E-module with available digital devices and its ease of integration into the learning process ($M = 3.60$). These results indicated that instructors perceived Multimodal Hypercontent E-Modules as accessible and feasible to integrate into firearms training activities.

Perceptions of Multimodal and Hypercontent Features

The results of the descriptive statistical analysis of instructors' perceptions regarding the multimodal-hypercontent dimension are presented in Table 5.

Table 5. Descriptive Statistics of the Multimodal-Hypercontent Dimension

Indicator	Mean	SD	Category
E-module supports interaction and learning activities	3.40	0.55	Very High
E-module connects theory with real-world visualizations	4.00	0	Very High
E-module increases student engagement	3.60	0.55	Very High
Hypercontent features support independent learning resources	4.00	0	Very High
Average	3.75	0.27	Very High

Based on Table 5, all indicators of multimodal-hypercontent features were categorized as very high. This dimension obtained the highest mean score compared with the other two dimensions. The highest-scoring indicators were the ability of the E-module to facilitate learning experiences that connected theoretical concepts with real-world visualizations and the ability of hypercontent features to support independent learning resources ($M = 4.00$).

Discussion

Perceived Usefulness of Multimodal Hypercontent E-Modules

The findings of this study indicated that the perceived usefulness dimension obtained a mean score of 3.55, which was categorized as very high. This result indicated that instructors perceived Multimodal Hypercontent E-Modules as beneficial for supporting firearms knowledge and shooting skills training. This positive perception indicated that instructors viewed the E-modules not only as media for delivering information but also as learning tools that could support students' systematic understanding of training materials before participating in practical activities (Liesa-Orús et al., 2022).

This finding aligned with the Technology Acceptance Model (TAM), which explains that perceived usefulness is a primary factor influencing users' acceptance of technology. When technology is perceived as useful for supporting work performance or learning processes, users are more likely to accept and adopt it. This finding was consistent with the meta-analysis by Scherer et al. (2019), which showed that perceived usefulness had a significant influence on educational technology acceptance.

In the context of military education, high perceived usefulness indicated that instructors viewed Multimodal Hypercontent E-Modules as a potential medium for bridging the gap between theoretical learning and field practice. This finding was important because firearms training represents a high-stakes procedural skill that requires conceptual readiness before learners engage with actual training equipment and operational environments.

Perceived Ease of Use of Multimodal Hypercontent E-Modules

The perceived ease of use dimension obtained a mean score of 3.50, which was categorized as very high. This finding indicated that instructors perceived Multimodal Hypercontent E-Modules as easy to use and easy to integrate into learning activities. A high perceived ease of use suggested that instructors perceived minimal obstacles in utilizing the digital media as part of the learning process.

According to Davis (1989), perceived ease of use is a key determinant of technology acceptance. Technology perceived as easy to understand and operate is more likely to be accepted by users. The findings of this study were consistent with previous research showing that perceived ease of use positively contributes to educational technology adoption (Liesa-Orús et al., 2022; Scherer et al., 2019).

Furthermore, the high score regarding the E-module's compatibility with available digital devices indicated that implementing this media was perceived as feasible within military education environments. The alignment between media characteristics and available infrastructure is an important factor in supporting the integration of learning technology.

Perceptions of Multimodal Hypercontent E-Module Features

The multimodal-hypercontent dimension obtained the highest score among the three dimensions ($M = 3.75$). This finding indicated that instructors valued Multimodal Hypercontent E-Modules not only for their technological aspects and ease of use but also, more importantly, for their ability to provide concrete and

contextual learning representations. In other words, instructors valued the media's potential to support procedural understanding beyond merely providing ease of use.

The two indicators that received the highest scores were related to the e-module's ability to connect theoretical concepts with concrete visualizations. This finding suggested that instructors viewed procedural visualization as a crucial component of firearms training. Unlike conceptual learning, which can often be conveyed through verbal or textual explanations, firearms training requires understanding of action sequences, body positioning, component operation mechanisms, safety procedures, and the consequences of each step. Therefore, instructional media should provide visual representations that clearly illustrate procedures before learners engage in hands-on practice.

The high scores obtained in the multimodal-hypercontent dimension can also be explained by the characteristics of firearms training as high-risk procedural learning. In this type of learning, procedural errors may not only affect competency achievement but also potentially pose safety risks. Therefore, instructors tended to view media that could visualize procedures in detail as more valuable than media that only presented textual information. This finding indicated that instructors viewed Multimodal Hypercontent E-Modules as tools with the potential to bridge the gap between theoretical understanding and practical implementation (theory–practice gap).

This finding was consistent with the Cognitive Theory of Multimedia Learning, which states that the combination of verbal and visual representations supports learners in constructing stronger mental models of the materials being learned (R. E. Mayer, 2021). The integration of text, images, procedural videos, and hypercontent navigation provides opportunities for learners to develop more accurate mental representations of the procedures being learned. Providing visual representations of weapon-handling procedures before practice may reduce cognitive demands during training activities and allow learners to focus more on skill mastery and safety procedures.

The findings of this study were also consistent with Radianti et al. (2020), who found that immersive learning technologies could enhance student engagement and understanding through more authentic learning experiences. Furthermore, Mills et al. (2025) reported that multimodal learning environments supported self-directed learning and improved procedural understanding compared with conventional learning media. In the context of this study, the integration of hypercontent and multimodal features provided opportunities for learners to access interconnected learning resources, review materials as needed, and obtain richer learning experiences before engaging in practical exercises (Knobovitch et al., 2025).

Thus, these findings suggested that the primary strength of Multimodal Hypercontent E-Modules lies not only in their digital format but also in their ability to provide procedural visualizations that support connections between theoretical concepts and field practice. These findings provide an important contribution to educational technology development in military contexts by emphasizing that learning media design for high-stakes procedural skills should prioritize quality visual representations and multimodal learning experiences rather than merely presenting information in digital formats.

Practical Implications

The findings of this study indicated that the multimodal-hypercontent dimension obtained the highest score compared with the other dimensions. This finding indicated that instructors placed greater value on the media's ability to provide procedural visualizations rather than solely on its technical aspects. Therefore, the development of learning media for high-stakes procedural skills training should prioritize the integration of multimodal elements, such as procedural videos, step-by-step illustrations, animations, and hypercontent navigation, to enable learners to access information flexibly and repeatedly according to their learning needs (Fei, 2024; R. E. Mayer, 2021).

The findings of this study also implied that learning media development should not focus solely on material digitization but should also consider the quality of information presentation. The instructors' high appreciation of multimodal features suggested that the combination of text, images, videos, and interactive links could better support learning that requires understanding complex and sequential procedures (Tjorven et al., 2026). Therefore, learning media design should focus on the ability to visualize processes, provide concrete examples, and support learners in connecting theoretical concepts with field practice.

In the context of military education, Multimodal Hypercontent E-Modules have the potential to be used as pre-training media before practical training. This media has the potential to support students' conceptual and procedural understanding before practical training, potentially allowing more efficient use of field training time for skill reinforcement and procedural error correction (Knobovitch et al., 2025). Furthermore, the characteristics of hypercontent, which allow independent access to various learning resources, also have the potential to support the development of self-directed learning among students (Mills et al., 2025). Thus, digital learning media can serve not only as a source of information but also as a potential means of supporting students' readiness for independent learning before interacting with actual training equipment and environments.

The findings of this study can be considered by media developers, instructors, and curriculum managers when designing digital teaching materials aligned with the characteristics of procedural skills learning. Although this research was conducted in the context of firearms training, the design principles emphasizing procedural visualization, multimodal integration, and flexible learning access have the potential to be applied to other technical training areas requiring procedural precision and high safety standards.

CONCLUSION

This study concludes that instructors at the Indonesian Air Force Officer Formation School (Setukpa TNI-AU) perceived Multimodal Hypercontent E-Modules as a useful, accessible, and potentially supportive digital learning medium for firearms knowledge and shooting skills training. The integration of multimodal representations and hypercontent features was perceived as relevant to connecting theoretical knowledge with procedural visualization and supporting learners' preparation before practical training. These findings highlight the potential of

Multimodal Hypercontent E-Modules to complement high-risk procedural skills training in military education. However, because this study focused on the perceptions of five instructors from a single institution, further research with broader participants and experimental or quasi-experimental designs is needed to determine their effectiveness in improving students' learning competencies and procedural skills.

Military educational institutions can consider implementing Multimodal Hypercontent E-Modules as pre-training media to support students' readiness before participating in practical training. Furthermore, the development of digital learning media for procedural skills should integrate multimodal and hypercontent elements to support procedural visualization, independent learning, and connections between theory and practice.

ACKNOWLEDGEMENT

The author would like to express gratitude to the Indonesian Air Force Officer Formation School (Setukpa TNI-AU) and all instructors who supported and participated in this study.

REFERENCES

- Andayani, Prabowo, S., Gafur, A., Situmorang, R., & Setiawan, B. (2024). Student Perceptions of Desired Learning Media Technology Development. *JTP - Jurnal Teknologi Pendidikan*, 26(2), 642–656. <https://doi.org/http://dx.doi.org/10.21009/JTP2001.6>
- Beeler, N., Ziegler, E., Volz, A., Navarini, A., & Kapur, M. (2023). The effects of procedural and conceptual knowledge on visual learning. *Advances in Health Sciences Education*, 29, 1243–1263. <https://doi.org/10.1007/s10459-023-10304-0>
- Bruzzone, A. G., & Massei, M. (2017). Simulation-Based Military Training. In S. Mittal, U. Durak, & T. Ören (Eds.), *Guide to Simulation-Based Disciplines: Advancing Our Computational Future* (pp. 315–361). Springer International Publishing. https://doi.org/10.1007/978-3-319-61264-5_14
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Drajati, N. A., Andayani, & Wijaya, S. A. (2025). Professional development on bilingual digital multimodal composing: Indonesian teachers' stories. *International Journal of Bilingual Education and Bilingualism*.
- Fei, V. L. (2024). The future of TESOL with multimodality. *International Journal of TESOL Studies*.
- Hasibuan, E. S., & Wibowo, K. T. (2024). *Senjata Api dan Tanggungjawab Profesi Polri- Jejak Pustaka*. Jejak Pustaka.
- Knobovitch, R., Tokuno, J., Botelho, F., Fried, H., Carver, T., & Fried, G. (2025). Virtual Reality Training Improves Procedural Skills in Mannequin-Based Simulation in Medical Students: A Pilot Randomized Controlled Trial. *Surgical Innovation*, 32, 364–373. <https://doi.org/10.1177/15533506251334693>

- Kooijman, K., Kleygrewe, L., Kennedy, D. J., de Vries, R., Oudejans, R. R. D., & Hutter, R. I. V. (2025). What triggers involuntary firearms discharges? – A scoping review. *Applied Ergonomics*, 129, 104566. <https://doi.org/https://doi.org/10.1016/j.apergo.2025.104566>
- Liesa-Orús, M., Latorre-Coscolluela, C., Sierra-Sánchez, V., & Vazquez-Toledo, S. (2022). Links between ease of use, perceived usefulness and attitudes towards technology in older people in university: A structural equation modelling approach. *Education and Information Technologies*, 28, 2419–2436. <https://doi.org/10.1007/s10639-022-11292-1>
- Mayer, R. (2024). The Past, Present, and Future of the Cognitive Theory of Multimedia Learning. *Educational Psychology Review*, 36. <https://doi.org/10.1007/s10648-023-09842-1>
- Mayer, R. E. (2021). *Multimedia Learning* (3rd ed.). Cambridge University Press.
- Mills, K. A., Brown, A., & Moro, C. (2025). Virtual and augmented reality text environments support self-directed multimodal reading. *Interactive Learning Environments*.
- Muhadi, M., Jarir, J., Khairina, K., Rajuna, R., & Prasetyo, E. (2025). Evaluasi perencanaan desain pembelajaran, pelaksanaan proses kegiatan pembelajaran, dan evaluasi instrumen hasil pembelajaran. *Edu Society: Jurnal Pendidikan, Ilmu Sosial Dan Pengabdian Kepada Masyarakat*, 5(2), 156–165.
- Pillai, P., Manchakkal, A., T.S, R., Saju, N., T.V, D., & K.M, V. (2026). An AI-Enabled Adaptive Visualization Approach to Overcoming Cognitive Barriers in Technical Terminology Learning. *International Research Journal on Advanced Engineering and Management (IRJAEM)*. <https://doi.org/10.47392/irjaem.2026.0231>
- Qiu, Y., Isusi-Fagoaga, R., & García-Aracil, A. (2023). Perceptions and use of metaverse in higher education: A descriptive study in China and Spain. *Computers and Education: Artificial Intelligence*.
- Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, 147, 103778.
- Rahate, A., Walambe, R., Ramanna, S., & Kotecha, K. (2021). Multimodal Co-learning: Challenges, Applications with Datasets, Recent Advances and Future Directions. *Inf. Fusion*, 81, 203–239. <https://doi.org/10.1016/j.inffus.2021.12.003>
- Ramadhan, M. R., Fahmi, M. I. N., & Hasanah, S. M. (2022). Augmented Reality Visualization through Multirepresentations Approach in Chemistry Based on Qur’anic to Improve Cognitive Learning Outcomes. *JTP - Jurnal Teknologi Pendidikan*, 24(2), 197–211. <https://doi.org/10.21009/JTP2001.6>
- Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach. *Computers & Education*.
- Selano, Y. P., Sutimin, L. A., & Sumaryati, S. (2024). Web-Based E-Module with a Project Based Learning Approach to Improve Computational Thinking Skills of High School Students. *Journal of Education Technology*, 8(4), 763–775.
- Simbolon, R., Saragih, A. H., & Situmorang, J. (2021). Development of Hypercontent Based Learning Model for High School Students. *Journal of Physics: Conference Series*, 1811(1), 012122.
- Sukmawati, F., Santosa, E. B., & Rejkiningsih, T. (2023). Virtual Reality-Based Learning about "Animals Recognition" and Its Influence on Students' Understanding. *JTP- Jurnal Teknologi Pendidikan*, 25(2), 269–284.
- Syahrial, Arial, Kurniawan, A. D., & Piyana, S. O. (2019). E-Modul Etnokonstruktivisme: Implementasi Pada Kelas V Sekolah Dasar ditinjau dari Persepsi, Minat, dan

- Motivasi. *JTP - Jurnal Teknologi Pendidikan*, 21(1).
<https://doi.org/https://doi.org/10.21009/jtp.v21i2.11030>
- Tjorven, S., Nora, M., Jost, S., Mathilde, G., & Kristina, F. (2026). The role of digital teaching methods in supporting practical skills training in the academic training of health professions – a scoping review. *BMC Medical Education*, 26.
<https://doi.org/10.1186/s12909-026-08785-9>
- Trente, A., Dubecq, C., Habas, S., Castel, F., Malgras, B., Travers, S., & Pasquier, P. (2026). Epidemiology of Deaths and Injuries in Special Operations Forces: A Systematic Review. *Military Medicine*, 191(5–6), e974–e983.
<https://doi.org/10.1093/milmed/usaf495>
- US Army Safety Center. (2022). *Fiscal Year 2022 Annual Assessment of the Army Safety Program*. Departement of the Army.